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Some Hydrobiid Snails from Georgia and Florida

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RECENT field work in Georgia and western Florida has revealed five new species of hydrobiid snails. These species are of particular interest because of their systematic and geographic affinities. The new taxa described below change concepts on the systematics of species and genera previously described from the eastern and northcentral United States. The species are herein described prior to more extensive studies of older known taxa so that the new species may be referred to in studies of parasitology and ecology currently underway in Florida and Georgia.

All of the species dealt with below belong to the group that I called the *Somatogyrus* tribe (Thompson, 1968). Subsequent to the Florida study it was discovered that other genera, including *Marstonia* F. C. Baker, belong to this group, while *Somatogyrus* differs conspicuously from these other genera by having a verge similar to that of *Gillia* Stimpson, 1865, as is described below.

The only available name is Nymphophilinae Taylor, 1966 for this group of North American hydrobiids that is characterized by the possession of dermal glands on the verge and a blade-like penis situated along the right distal margin of the verge (Thompson, 1968). *Somatogyrus* and *Gillia* should probably be placed in the subfamily Lithoglyphinae Troschel, 1856 (see Taylor, 1966).

ACKNOWLEDGMENTS

For bringing to my attention the interesting hydrobiid fauna present in the Ocmulgee River system and for assistance in field work I am grateful to Mr. Richard W. Heard, Jr., Marine Institute, University of Georgia. Dr. Harold J. Walter, Dayton,

Ohio, has provided me with anatomical material of *Marstonia lustrica* (Pilsbry). The shell drawings accompanying this paper are due to the skillful artistry of Miss Susan Myking, Gainesville, Florida.

*Marstonia* F. C. Baker, 1926

Type species by original designation: *Amnicola lustrica* Pilsbry, 1890.

Baker (1928: 104) included seven species in *Marstonia*: *Amnicola lustrica* Pilsbry, *A. gelida* F. C. Baker, *A. oneida* Pilsbry, *A. walkeri* Pilsbry, *A. pilsbryi* Walker, *A. greenensis* F. C. Baker and *A. winkleyi* Pilsbry. Of this series *A. walkeri* and *A. pilsbryi* are known to belong to *Amnicola*, s. g. *Lyogyrus* (Thompson, 1968). *A. oneida* and *A. winkleyi* are anatomically unknown and cannot be placed with certainty in any recognized genus. Baker (1928) stated that the animal of *A. oneida* was like that of *A. lustrica*, but his observations on *lustrica* are so much in error that his comparison is of dubious value. *A. gelida* and *A. greenensis* are Pleistocene fossils. Speculation about their generic affinities is fruitless. Thus the only species unequivocally placed in *Marstonia* is the genotype, *A. lustrica*. The anatomy of this species has been adequately described and illustrated by Berry (1943).

The discovery of the new species described below significantly changes the concept and definition of *Marstonia* as given by Berry (1943). The genus is redefined as follows:

Shell attenuate, almost twice as high as wide. Apex elevated. Apical whorl protruding and rounded. Aperture ovate or subovate. Peristome continuous or discontinuous across parietal wall. Umbilicus narrow, perforate.

Verge stout, weakly bifid at distal end. Left distal margin projecting as a low pedicel which bears an enlarged epidermal gland. (This gland is probably homologous to the apical crest of *Cincinnatia*). Penis at extreme right, and projecting from end of verge.

The radula is non-distinctive except that it is relatively minute. It consists of 42-47 transverse rows of teeth. The central tooth bears a single basocone on each side, an enlarged mesocone and 3-5 ectocones on each side of the mesocone. The lateral tooth bears 2-3 entocones, an enlarged mesocone and 4-5 ectocones. The two marginal teeth each bear about 15-20 minute cusps.

The relationship of *Marstonia* to other genera within the subfamily Nymphophilinae is difficult to determine. In contrast to most other genera the only gland present on the verge is the raised epidermal gland along the left distal margin. In this respect *Marstonia* is similar to *Rhaphinema*. Both genera are also similar to having a single basocone on each half of the central tooth of the radula. The genera differ so remarkably in shell structure and shape that a close relationship within the subfamily does not seem likely. The similarities of their anatomies may be only the result of seeming convergence through the loss of other features.

*Marstonia agarhecta* new species

DIAGNOSIS. A species placed in *Marstonia* because of characteristics of its verge. The verge bears a single enlarged epidermal gland raised on a low fleshy pedicel along its left margin, and has a short penis that terminates along the distal end of the verge. In characteristics of its verge it differs from *M. lustrica* (Pilsbry) by having a relatively longer but more slender penis, and by having the epidermal gland more restricted on the fleshy pedicel (see fig. 1, F-G for comparison). The shell is characterized by being of very small size, it is very fragile, it has an incomplete peristome and it has 4.4-4.6 whorls at maturity. *M. lustrica* has a considerably larger shell (about 4 mm long and 2.5 mm wide), the shell is solid though not thick, has a complete peristome and has about 5 whorls at maturity (an excellent description of *M. lustrica* is given by Berry, 1943).

SHELL (Fig. 1, A-D; Fig. 11). Minute, very thin and fragile. Conical, 0.65-0.74 times as wide as high. Shell dimorphic in shape, females tending to be broader than males. Narrowly umbilicate. Peristome grayish white. Shell transparent. Whorls 4.4-4.6; apical whorl 0.23-0.25 mm in diameter; protruding, strongly rounded and with a deep suture; with very fine close microscopic axial striations. Following whorls strongly rounded; suture deeply impressed. Body whorl weakly shouldered. Sculpture on lower whorls consisting of very fine, close incremental striations that are equal in intensity over the surface of the whorl. Aperture ovate, 0.45-0.52 times height of shell; 0.77-0.83 times as wide as high. Aperture oblique, axis lying at about 30° to shell axis. Only

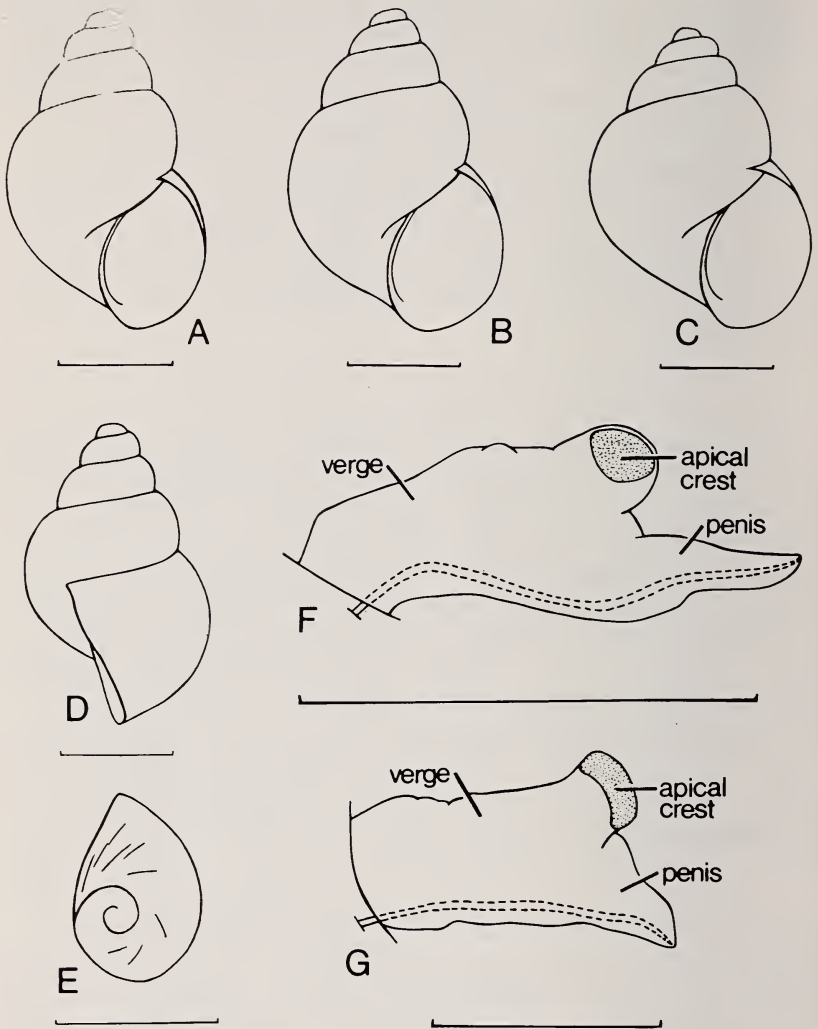


Fig. 1. *Marstonia agarhecta* n.sp. (A-F) and (G) *Marstonia lustrica* (Pilsbry) from canal, Midway, Clark County, Ohio. A, D, holotype. B-C, paratypes. E, operculum. F-G, dorsal surface of verge. Scales equal 1 mm.

slightly oblique to shell axis in lateral profile. Peristome discontinuous across parietal wall. Parietal callus consisting only of a very thin glaze. Columella concave, very thin, weakly reflected. Outer

lip weakly arched forward above periphery, slightly reflected near weakly arched forward above periphery, slightly reflected near base.

Measurements of large specimens (holotype in parenthesis): length of shell, 2.3-2.7 mm (2.65); width of shell, 1.6-1.95 mm (1.75); aperture height, 1.1-1.3 mm (1.2); aperture width, 0.9-1.05 mm (0.95).

**OPERCULUM** (Fig. 1, E). Very thin, membranous. Broadly ovate, slightly indented along parental margin. Colorless or only slightly tinged with yellow. Consisting of about 2.5 whorls. Paucispiral. Nucleus large, located at about one third of distance from the base to the apex and from the columellar margin to the opposite side. Outer surface sculptured with a few fine incremental striations.

**VERGE** (Fig. 1, F). The verge originated on the nape slightly to the right of the mid-dorsal line and beneath the mantle collar. It is stout and slightly compressed dorso-ventrally. The distal left margin terminates in a weakly lobed pedicel that bears an enlarged epidermal gland. The penis lies along the extreme right and distal margin of the verge. It is relatively long and slender compared to *M. lustrica* (see Fig. 1, G for comparison). The vas deferens lies along the right margin of the verge and terminates at the tip of the penis.

**RADULA**. Minute, about 450  $\mu$  long, and containing about 42-46 transverse rows of teeth (10 specimens examined). Central tooth about 19  $\mu$  wide and bearing an enlarged mesocone with 3-5 ectocones and 1 basicone on each side. The lateral tooth bears 2-1-4 to 3-1-5 cusps. Two marginal teeth each bear about 20 minute cusps. The structure of the central and lateral teeth do not differ from those of *M. lustrica* as described and illustrated by Berry (1943, pl. III, fig. 3).

**TYPE LOCALITY**. Bluff Creek, 10.4 miles south-southeast of Hawkinsville, Pulaski County, Georgia. **HOLOTYPE**: UF 20528; collected 31 January, 1969 by Fred G. Thompson. **PARATYPES**: UF 20529 (296); same data as holotype.

Specimens were collected in clear water with only a slight current. They were found predominately in diatomaceous ooze on top of old submerged logs. A few specimens were also found in silt that contained large amounts of diatoms, but such specimens

were only infrequently encountered, whereas specimens on submerged logs were abundant.

REMARKS. This species is known only from the type locality, although it may occur in other tributaries of the Ocmulgee River

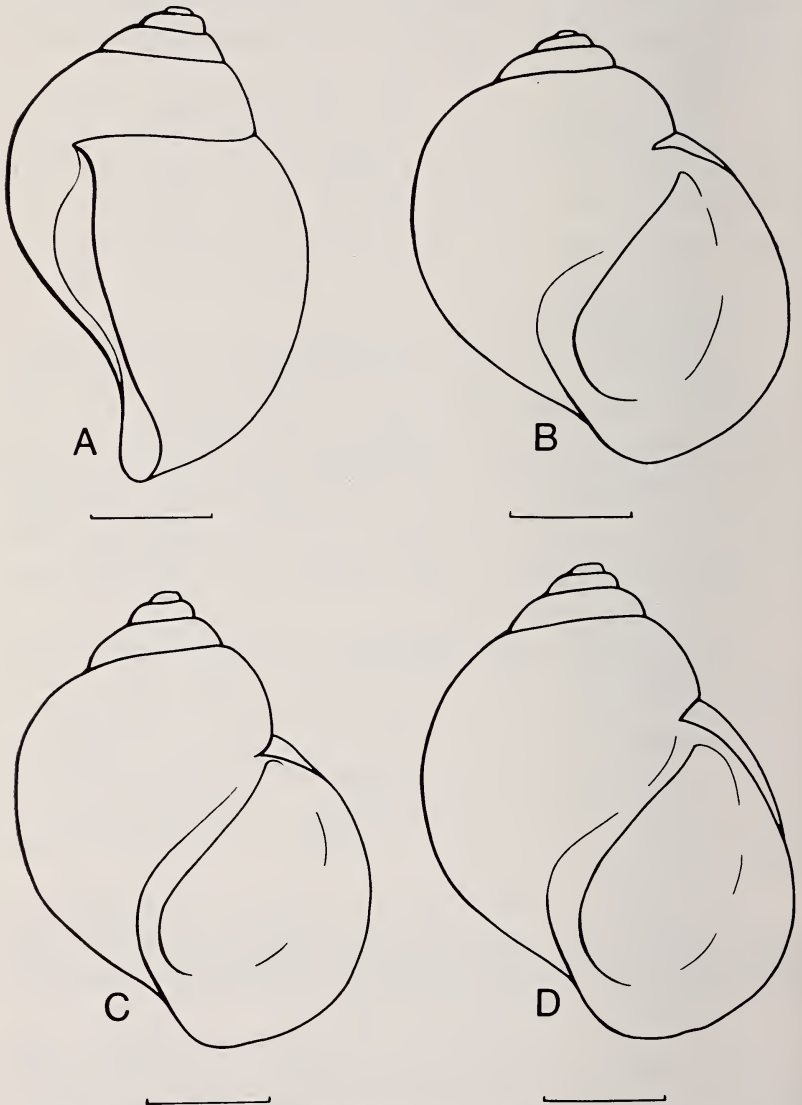


Fig. 2. *Rhapinema dacryon* n.g. n.sp. A-B, holotype. C-D, paratype. Scales equal 1 mm.

system. It is remarkably isolated in its distribution from *M. lustricia*. The latter species has been recorded only from states bordering the Great Lakes.

*Rhaphinema* new genus

TYPE SPECIES. *Rhaphinema dacryon* new species. The genus is monotypic.

DEFINITION. A member of the family Hydrobiidae Troschel, 1856 and the subfamily Nymphophilinae Taylor, 1966. It is placed in this relationship by possessing in the verge a single duct, the vas deferens, by having a laterally situated penis on the right margin of the verge and by having glandular masses on the surface of the verge.

*Rhaphinema* is characterized by and differs from other genera in the subfamily by having a long flagellar penis that originates along the right margin but near the tip of the verge and by having a single small glandular patch along the right distal margin of the verge. Also, glands are absent on the surface of the penis unlike other genera of the Nymphophilinae. Characteristics of the radula are non-distinctive, except that the cusps on the lateral tooth have their cutting edges linearly arranged as opposed to being acuminate as occurs in other related genera.

The shell is broadly ovate, imperforate and thick with about 4.0-4.5 whorls. The peristome is incomplete across the parietal margin which has only a thin glaze. The columellar margin has a thick wide callus. The apical whorl is 0.26-0.29 mm in diameter and is weakly constricted by the suture. The apical whorl is sculptured with minute dense punctations. Characteristics of the operculum are non-distinctive but are described below in the account of the species.

The shell retains generalized aspects and shows no special character that allows identification except at the specific level. Part of this dilemma is due to the many species described as *Somatogyrus* which remain anatomically unknown. Not considering *Somatogyrus*, *Rhaphinema* differs from other genera, except *Nymphophilus*, by having an incomplete peristome across the parietal margin. Its shell differs from that of *Nymphophilus* in that the latter is umbilicate and is trochoid in shape.

The relationship of *Rhaphinema* is remote to other genera of the Nymphophilinae. All of the known genera placed in the subfamily have a penis that is generally blade-like and originates nearer the middle of the right margin of the verge. Also, other

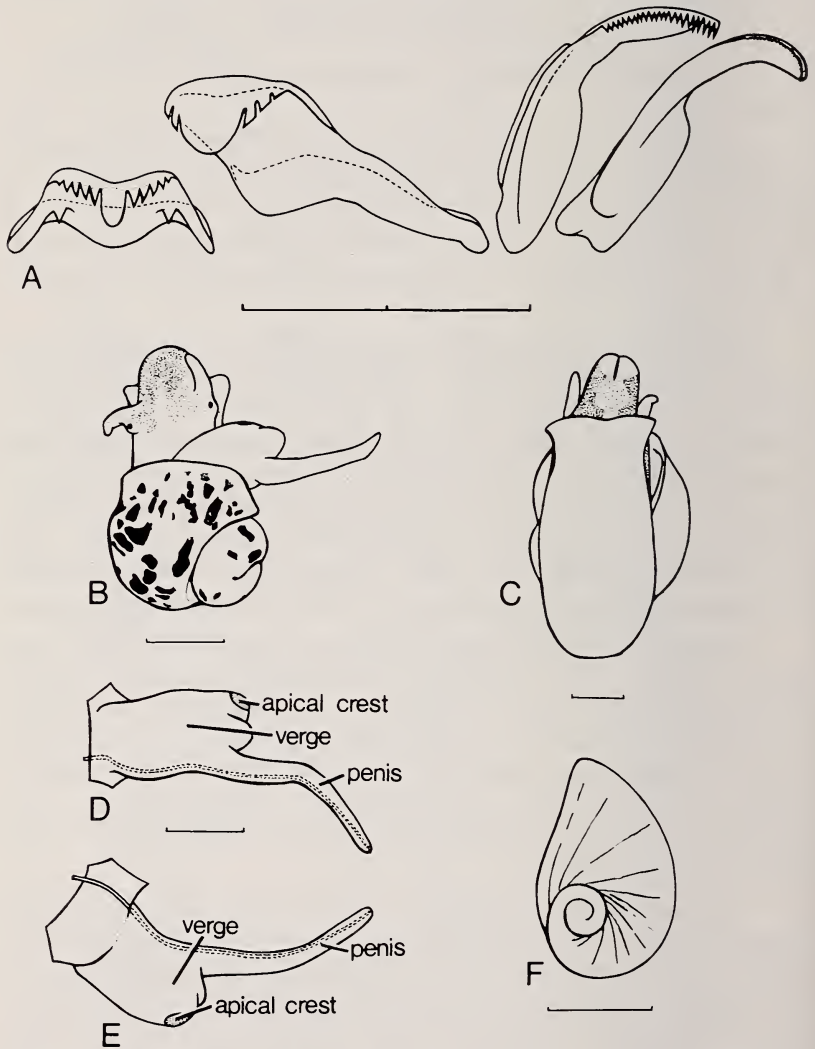


Fig. 3. *Rhaphinema dacryon* n.g. n.sp. A, radula. B, dorsal view of male denuded of the shell. C, ventral view of animal showing shape of foot. D, dorsal view of verge. E, ventral view of verge. F, operculum. Scale for A equals 100  $\mu$ . Scales for B-F equal 1 mm.



genera of the subfamily have a stronger development of glandular masses on the surface of the verge. None possess a pattern of glands that is similar to that of *Rhaphinema*, or would allow such a pattern to be derived directly from it without major evolutionary deletions. The absence of glands on the penis and its size and shape indicate that *Rhaphinema* is a member of the Nymphophilinae that evolved early from the stock that gave rise to the remaining genera of the subfamily. Other evidences of the radula, operculum or shell are not contradictory to this relationship.

The generic name *Rhaphinema* is derived from the Greek *rhapis*, meaning rod and *nema*, meaning thread and alludes to the general shape of the verge. The name is of the neuter gender.

*Rhaphinema dacryon* new species

SHELL (Fig. 2, A-D; Fig. 10, upper left). Moderately sized, compactly coiled. Ovate-elliptical, 0.80-0.90 times as wide as high. Thick, translucent. Grayish white. Periostracum absent. Imperforate. Post-columellar groove absent. Spire elevated, slightly convex in outline. Suture moderately impressed through length of spire. Whorls 4.1-4.5, regularly increasing in size, not shouldered. Body whorl nearly uniformly rounded from suture to base. Sculpture consisting of very fine incremental striations that are most prominent behind outer lip. Apical whorl 0.26-0.29 mm in diameter perpendicular to initial suture. Apical whorl protruding, rounded and may be slightly offset above following whorls by slight constriction of suture, densely sculptured with minute granules. Aperture broadly auriculate, 0.63-0.71 times height of shell, 0.79-0.88 times as wide as high. Aperture axis lying at about 45° to shell axis. Peristome not continuous across parietal margin. Columellar callus thick, rounded, widely reflected over umbilical area, tapered below and continued above only as a thin glaze over parietal wall. Columellar callus bounded with a slight impression below umbilical area. Outer lip in mature specimens with a thick internal callus. Basal lip advanced near lower corner. Outer lip slightly arched forward.

Measurements (figures in parenthesis pertain to holotype): height, 3.0-3.8 mm (3.7); width, 2.5-3.1 mm (3.1); aperture

height, 2.0-2.4 mm (2.4); aperture width, 1.7-2.1 mm (2.0); length/diameter, 1.11-1.25; length/aperture, 1.41-1.58.

**OPERCULUM** (Fig. 3, F). Irregularly elliptical, columellar margin nearly straight. Thin, hyaline, light amber tinged. Consisting of about 2.5 whorls. Last whorl rapidly increasing in size. Nucleus located at about 1/3 of distance from base to apex and from columellar margin to outer margin. Outer surface with a few fine incremental striations.

**ANIMAL** (Fig. 3, B-C). Stocky. Foot spatulate, buntly rounded posteriorly, bilobed anteriorly. Snout extending beyond anterior margin of foot. Eye tentacles short and blunt, not extending beyond snout. Snout and sides of pedicel mottled with light gray on a dull white background. Mantle white with numerous small irregular-shaped black spots.

**VERGE** (Fig. 3, D-E). Originating beneath the mantle on the nape slightly to the right of the midline. Dorso-ventrally compressed. Terminal bulb small, simple, without integumental glands. *Apical crest small, restricted to distal margin of verge.* Glands absent from rest of verge and penis. Penis slender, elliptical in cross-section, slightly longer than verge. Vas deferens lying along right margin of verge and basal half of penis and discharging at tip of penis.

**RADULA** (Fig. 3, A). Consisting of 58-62 transverse rows of teeth (10 specimens examined). Central tooth with an enlarged mesocone and bearing 5-6 ectocones and one basocone on each side. Lateral with 2-1-3 cusps. Inner marginal tooth with 20-25 cusps. Outer marginal with 19-25 cusps.

**TYPE LOCALITY.** Chipola River, 1.4 miles north of Marianna, Jackson County, Florida. **HOLOTYPE:** UF 20503; collected 5 December, 1968 by Fred G. Thompson. **PARATYPES:** UF 20504 (900); same data as holotype.

**OTHER LOCALITIES.** Known only from the Chipola River drainage in Jackson County, Florida, where it has been collected at the following localities in addition to the type locality: Chipola River, 0.3 mi. e. Marianna (UF 20506); Blue Hole Spring, Florida Caverns State Park (UF 20505).

**REMARKS.** This species was abundant on aquatic vegetation at the three stations where it was collected. Large numbers were obtained by shaking mats of filamentous algae in a pail of

water. The species was sparse on bottom sediment and debris. At all three stations the water was clear, permitting visibility to the bottom. Patches of vegetation and algae were sparse and occurred over a silt-sand bottom.

*Notogillia sathon* new species

DIAGNOSIS. A species placed in *Notogillia* Pilsbry, 1953 because of the raised crest on the ventral surface of the verge bearing narrow, transverse glands. The verge differs from that of *N. wetherbyi* (Dall), the only other known species of the genus, in lacking numerous accessory glands on the dorsal surface and by having large glands near the distal right margin and on the penis. Other characters of the soft anatomy and radula are very similar in the two species. The shell of *N. sathon* is relatively small (about 4.0-4.5 mm long), is broadly ovate with a prominently inflated body whorl, has a grayish-white periostracum and has a conspicuously thickened and reflected columellar callus. The shell of *N. wetherbyi* is larger (about 4.5-7.5 mm long), is not as broadly ovate, the body whorl is not conspicuously inflated, the periostracum is olivaceous brown, and the columella is not conspicuously thickened or reflected but is perpendicular to the plain of the aperture. The operculum of *N. wetherbyi* is more intensely striate than that of *N. sathon*.

Shell characters alone would allow placement of *N. sathon* in *Somatogyrus* Gill, 1863. *Somatogyrus* has a simple, sickle-shaped verge that lacks dermal glands on the outer surface. *N. sathon* differs from this genus and is related to *Notogillia wetherbyi* (Dall) by its bifurcate, glandular verge.

SHELL (Fig. 4, A-D; Fig. 10, upper right). Moderate sized. Conico-globose, body whorl inflated. Spire elevated and with whorls regularly increasing in size. Shell 0.84-0.96 times as wide as high. Imperforate. Shell translucent, dull-shiney. Grayish white with a slight brownish tinge in the periostracum. Columellar callus opaque white. Whorls 4.2-4.4. Suture strongly and equally impressed along postapical whorls. Apical whorl elevated but not constricted by suture, 0.26-0.31 mm in diameter perpendicular to the initial suture, which is relatively shallow compared to subsequent suture. Whorls regularly descending to aperture and sculptured with fine incremental striations. Faint shallow spiral grooves are also present but are difficult to distinguish except along

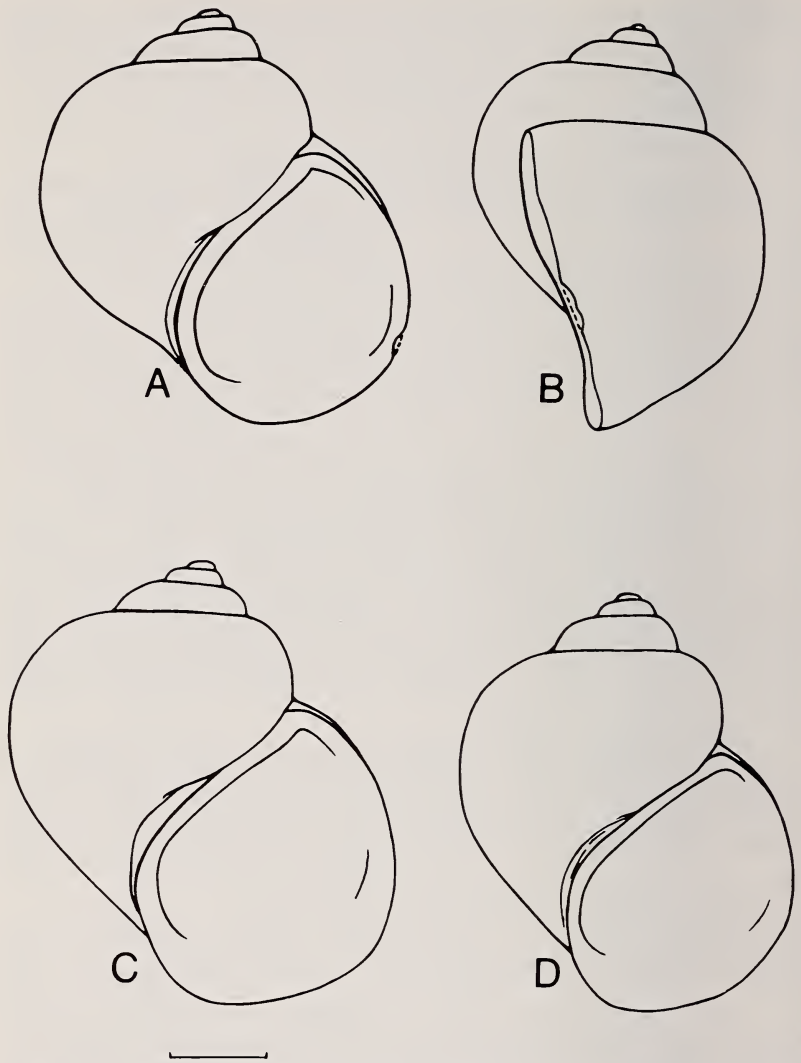


Fig. 4. *Notogillia sathon* n.sp. A-B, holotype. C-D, paratypes. Scale equals 1 mm.

the suture of the body whorl due to wear. The spiral grooves may be tinged with brown due to the unworn periostracum within them. Aperture large, 0.60-0.69 times length of shell. Aperture broadly auriculate, 0.85-0.96 times as wide as high. Aperture

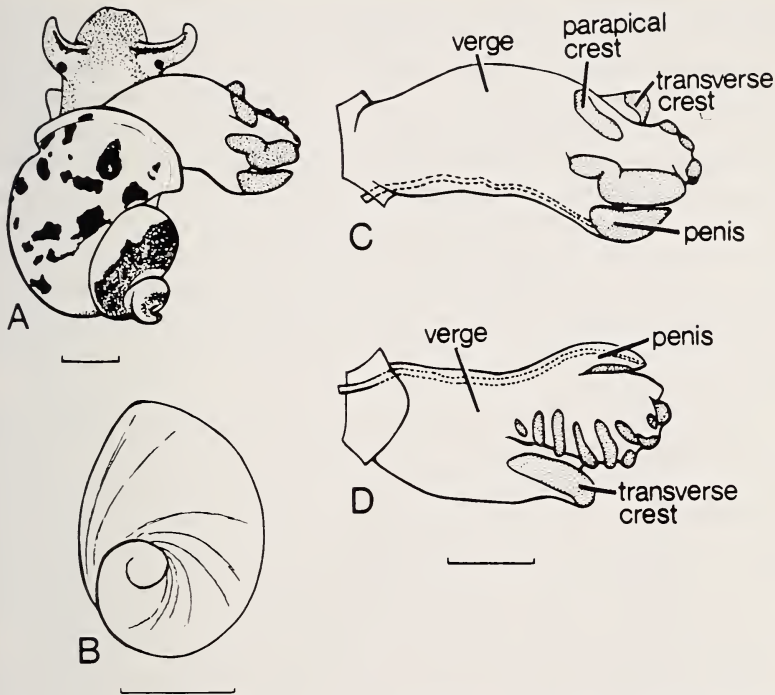


Fig. 5. *Notogillia sathon* n.sp. A, dorsal view of male denuded of shell. B, operculum. C, dorsal view of verge. D, ventral view of verge. Scales equal 1 mm.

axis at about  $40^\circ$  to shell axis. Plane of aperture at about  $30^\circ$  to shell axis. Peristome continuous across parietal margin. Columellar callus thick, rounded, slightly narrowing below and continuing above as a thick parietal callus. Columellar callus demarcated by a truncate impression below umbilical region. Outer lip sharp. Basal lip weakly indented. Baso-columellar margin weakly advanced. Plane of aperture lying at about  $30^\circ$  to shell axis in lateral profile.

Measurements (holotype in parentheses): height 4.1-4.5 mm (4.1); width, 3.5-4.2 mm (3.8); aperture height, 2.4-3.0 mm (2.7); aperture width, 2.3-2.7 mm (2.4); length/diameter, 1.04-1.19; length/aperture, 1.45-1.66.

OPERCULUM (Fig. 5, B). Ovate, thin, amber colored. Consisting of about 2.5 whorls that rapidly increase in size. Nucleus large, located at about  $2/5$  of distance from base to apex and

at about 1/3 of distance from columellar margin to outer margin. Outer surface with numerous moderate incremental striations.

ANIMAL (Fig. 5, A). Foot broadly spatulate, bilobed anteriorly, bluntly rounded posteriorly. Snout extending beyond anterior margin of foot. Snout and sides of pedicel and foot strongly mottled with melanophores. Eye tentacles short and stout with an irregular black stripe along dorsal surface. Eye located at base and outer margin of tentacle. Nape lighter gray posteriorly and with numerous irregular-shaped black spots. Upper whorls of body light orange, strongly but diffusely pigmented with black along dorsal surface. Gill consisting of 17-24 triangular lamellae that are nearly uniform, except near collar where they rapidly diminish in size.

VERGE (Fig. 5, C-D). Originating on the nape beneath the mantle collar and slightly to the right of the midline. It is dorso-ventrally compressed and bears a short stocky penis that is equal to about 1/5 of its length and does not extend beyond the end of the verge. The dorsal surface of the verge bears a short oblique *parapical* crest, and a larger sigmoid crest on the end of the terminal bulb. Another large glandular crest covers the dorsal surface of the penis. The ventral surface of the verge has an enlarged fold along the distal half bearing 10-11 narrow, transverse glandular crests. A large *transverse crest* lies near the middle of the left margin of the ventral surface. A small gland may also be present on the ventral surface of the penis.

RADULA. Containing 58-81 transverse rows of teeth (10 specimens examined). Central tooth with an enlarged mesocone and bearing 6-7 ectocones and one basocone on each side. Lateral tooth with 2-1-3 cusps. Inner marginal with 17-22 cusps. Outer marginal with 23-28 cusps.

TYPE LOCALITY. Georgia, Wilcox County, Osewichee Spring, 12.1 miles north and 1.9 miles east of Fitzgerald. HOLOTYPE: UF 20507; collected 3 December, 1968 by Fred G. Thompson. PARATYPES: UF 20508 (700); same data as the holotype.

OTHER LOCALITIES. This species is known only from small streams and springs draining into the Ocmulgee River in south-central Georgia. Besides the specimens from the type locality I have examined material from the following places. *Ben Hall County*: House Spring, 8.9 mi. n. Fitzgerald (UF 20512, 20513). *Pulaski*

*County*: Bluff Creek, 10.4 mi. SSE Hawkinsville (UF 20514, 20515); Bluff Creek, about 2 mi. n., 2.0 mi. e. Pineview (UF 20516); Big Creek, 3.8 mi. s. Hawkinsville (UF 20511); creek, 3.3 mi. SSE Hartford (UF 20510).

REMARKS. The description and measurements of the shell pertain only to specimens from the type series. Some populations from other localities possess peculiarities of shell size and shape that are distinct and consistent, so that taxonomic recognition of other forms could be justified. Morphological features of the reproductive system are uniform throughout the range of the species, indicating that shell variations between different populations are only of minor significance and at the subspecific level.

The population occurring at House Spring, Ben Hill County is peculiar in that the shell is decidedly larger than occurs in other populations, and the baso-columellar corner of the peristome is not advanced as a tongue-like projection but is weakly concave. These two aspects of the shell readily distinguish this population from others, but taxonomic recognition of the population is not advisable without additional knowledge of the distribution and variation of this form and others of the species.

Snails from creeks in Pulaski County have a more elevated spire than do shells from the type series, and the columellar callus lacks the shallow impression behind it such as occurs in the typical form. The post-columellar impression is caused in *N. sathon*, in part, by heavy deposits of calcium carbonate on the surface of the shell, which are eroded away as the callus encroaches through growth. Thus, the presence or absence of this character is environmentally influenced.

Most shell samples that have been examined do not possess the strongly developed parietal callus that prevails among specimens from the type locality, although all specimens have a heavy, wide columellar callus. The lack of the parietal callus is an age factor, and its absence from shells in some samples may be due to the time of the year in which they were collected (January).

### *Spilochlamys turgida* new species

DIAGNOSIS. A species of *Spilochlamys* most clearly related to *S. gravis* Thompson because of characteristics of the verge (Thompson, 1968: 115; Fig. 42, A, B). In *S. turgida* and *S.*

*gravis* the terminal margin of the verge lacks of glandular crests such as occurs in *S. conica* Thompson, and the accessory glands on the dorsal surface tend to be arranged in a circular pattern. The verge of *S. turgida* differs from that of *S. gravis* by having much smaller glands arranged in a circular pattern, and the gland along the right margin of the penis continues along the right distal

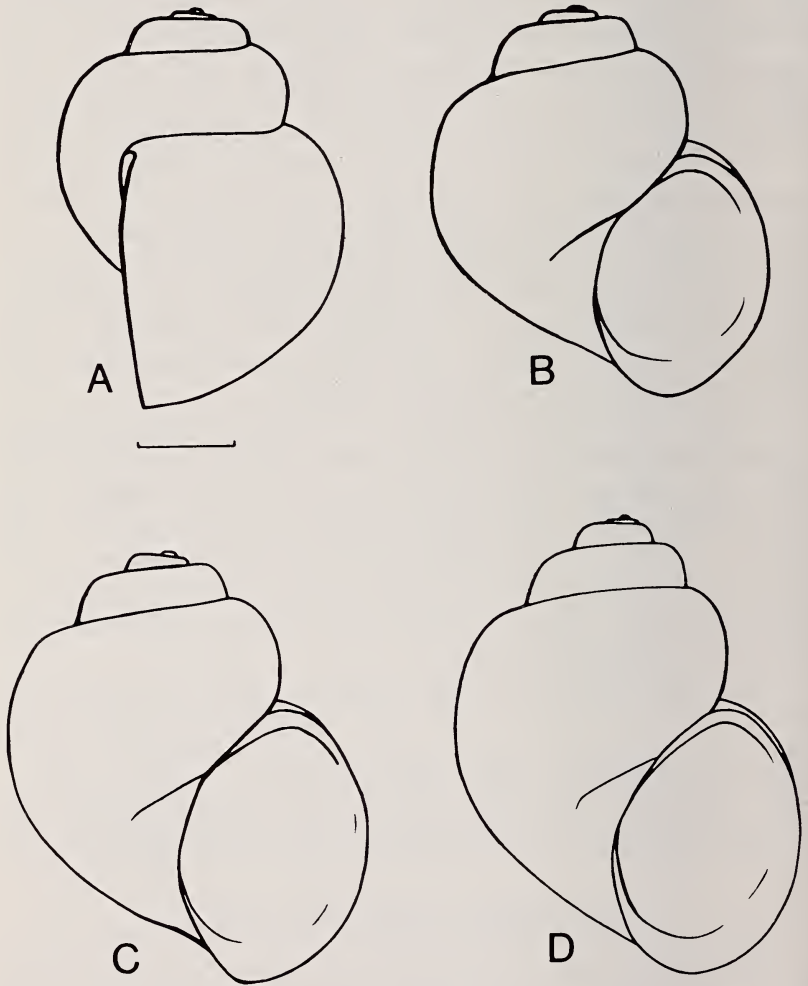


Fig. 6. *Spilochlamys turgida* n.sp. A-B, holotype. C-D, paratypes. Scale equals 1 mm.



margin of the verge. The shell of *S. turgida* is characterized by and differs from the other species in its obovate shape, its short spire with depressed apical whorls, its deep suture, its strongly rounded, shouldered whorls, its nearly ovate aperture which is but weakly extended below and its relatively large umbilicus.

**SHELL** (Fig. 6, A-D; Fig. 10, lower left). Obovate. Light olivaceous brown. Periostracum with a dull luster. Interior of aperture hyaline, sometimes livid in large specimens. Shell thick, translucent, nearly transparent. Openly umbilicate. 4.3-4.5 whorls in large specimens. Suture deeply impressed along the whorls, including embryonic shell. Whorls strongly inflated, shouldered, slightly flattened above the periphery of body whorl. Apical whorl 0.22-0.30 mm in diameter perpendicular to initial suture (usually 0.23-0.25 mm), sparsely sculptured with fine axial striations. First half of apical whorl conspicuously elevated above following whorl. Lower whorls with regularly-spaced strong axial striations that are continuous from the suture to the umbilicus where the striations become slightly enlarged. Aperture large, 0.53-0.61 times the length of the shell; ovate, 0.76-0.87 times as wide as high. Axis of aperture lying at about  $40^\circ$  to shell axis. Plane of aperture in lateral profile parallel to shell axis. Upper corner of aperture thickened and rounded. Lower corner thickened and in larger specimens may be slightly advanced (as in Fig. 6, C). Columellar margin thin, sharp, sometimes slightly reflected. Peristome continuous across parietal wall. Outer lip in lateral profile weakly retracted near the upper corner.

Measurements of large specimens (holotype in parenthesis): height, 3.7-4.5 mm (3.9); width, 3.1-3.7 mm (3.4); aperture height, 2.1-2.5 mm (2.3); aperture width, 1.7-2.0 mm (1.8); length/diameter, 1.11-1.24; length/aperture, 1.64-1.88.

**OPERCULUM** (Fig. 7, D). Oblong-ovate, thin, amber colored, consisting of about 2.5 whorls. Nuclear whorl located at about 1/3 of distance from base to apex and from columellar margin to outer margin. Nucleus minutely granular on inner surface. Remaining whorls with fine incremental striations on outer surface.

**ANIMAL**. Similar to *S. conica* Thompson except pedicel and sides of foot light gray, becoming darker on nape. Mantle

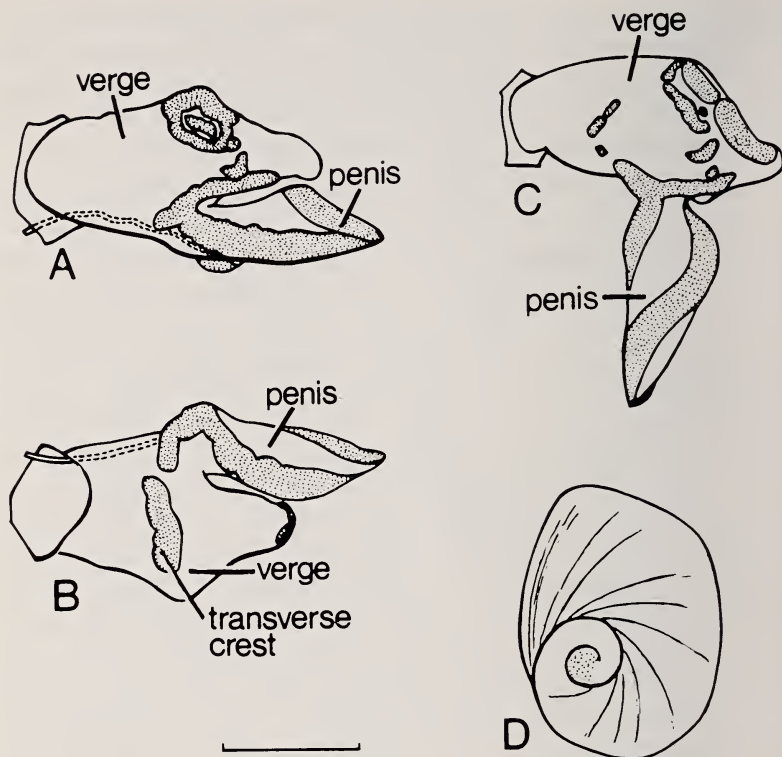


Fig. 7. *Spilochlamys turgida* n.sp. A, C, dorsal view of verge. B, ventral view of verge A. D, operculum. Scale equals 1 mm.

heavily and diffusely pigmented with black, becoming more intense on dorsal surface of upper whorls.

**VERGE** (Fig. 7, A-C). Stocky, tapering to a slender tip and constricted near the base. A large penis originates near middle of right margin and extends beyond tip of verge for 1/3 of penis length. As is typical of the genus the penis is spirally twisted when erect. Dorsal surface of verge with a few small accessory glandular crests that tend to form a loop or an elongate U near the right margin. An elongate glandular crest lies along right distal margin of verge and is continuous with heavy glandular crest along right margin of the penis. Left margin of the penis also with a heavy glandular crest which may be twisted onto ventral surface near base of penis. Ven-

tral surface of verge with a moderately developed transverse crest that may extend to the left margin.

**RADULA.** Consisting of 52-62 transverse rows of teeth (10 specimens examined). Central tooth with 3-4 ectocones and one basocone on each side. Lateral tooth with 2-1-3 or 2-1-4 cusps. Inner marginal tooth with 8-10 cusps. Outer marginal tooth with 9-10 cusps.

**TYPE LOCALITY.** Georgia, Wilcox County, Osewitchee Spring, 12.1 miles north and 1.9 miles east of Fitzgerald. **HOLOTYPE:** UF 20517; collected 3 December 1968 by Fred G. Thompson. **PARATYPES:** UF 20518 (850); same data as the holotype.

**OTHER LOCALITIES.** Extant populations of this species are known only from the small streams and springs draining into the Ocmulgee River in south-central Georgia. In addition to the type series specimens have been examined from the following places: *Ben Hill County:* House spring, 8.9 mi. n.n.e. Fitzgerald (UF 20524). *Pulaski County:* Bluff Creek, 10.4 mi. s.s.e. Hawkinsville (UF 20525); Big Creek, 3.8 mi. s. Hawkinsville (UF 20521); creek, 3.3 mi. s.s.e. Hartford (UF 20519); Bluff Creek, about 2 mi. n., 2.0 mi. e. Pineview (UF 20523).

Specimens provisionally identified as this species also have been collected in an early Pleistocene deposit at Haile, Alachua County, Florida (Univ. Florida Invertebrate Fossil Collections).

**REMARKS.** The generic relationship of *S. turgida* is clearly indicated by characteristics of the verge. As with the other two species of *Spilochlamys* the verge has an enlarged blade-like penis that is spirally twisted when erect and bears thick glands along its two edges. The transverse gland is the only gland present on the ventral surface of the verge, and the dorsal surface bears only a localized arrangement of accessory glands. This combination of glands and their arrangement distinguish *Spilochlamys* from all other genera in which the anatomy has been described.

The shell of *S. turgida* shows little in common with other species in the genus. The obovate shape with the depressed spire, strongly rounded, shouldered whorls, ovate aperture and wide umbilicus produce such a different appearance that the generic relationship of *S. turgida* would not be suspected by shell characters

TABLE 1

Comparisons of the radula in three species of *Spilochlamys*

Species	Rows	Central Ectocones	Lateral	Inner Marg.	Outer Marg.
<i>turgida</i>	52-62	3-4	(1-1-3) - (2-1-4)	8-10	9-10
<i>gravis</i>	67-83	4-6	(3-1-5) - (3-1-6)	20-25	20
<i>conica</i>	45-53	5-6	(3-1-5) - (3-1-7)	20	30

Differences refer to the number or transverse rows of teeth, number of ectocones on each half of the central tooth, and the number of cusps on the lateral, the inner marginal, and the outer marginal teeth.

alone. The radula of *S. turgida* also differs strikingly as is shown in Table 1.

#### *Somatogyrus (Walkerilla) tenax* new species

DIAGNOSIS. A species of the subgenus *Walkerilla* Thiele, 1928 by virtue of characteristics of its verge, radula and sculpture on the apical whorls of the shell. It is characterized by its broadly conical or trochoid shape, medium-sized, narrowly umbilicate shell, concave columella and boardly indented outer-basal lip. Within the subgenus it is most similar to *S. virginicus* Walker but differs from that species by its smaller size, sloping, unshouldered whorls and perforate shell. *S. virginicus* has rounded, weakly shouldered whorls and is imperforate.

SHELL (Fig. 8, A-E; Fig. 10, lower right). Medium-sized. Broadly trochoid or conical in shape, but with a strongly eroded apex so that only 2.0-2.4 whorls persist in adults. Height of last whorl 1.00-1.07 times width of shell. Periostracum thin, greenish yellow, shiny when clean but usually covered with a black ferruginous deposit. Shell solid but not noticeably thickened except along columella. Rimate or narrowly umbilicate. Apical whorls when present 0.40-0.43 mm in diameter perpendicular to initial suture, moderately deflected, sculptured with fine spiral striations which begin on first quarter of whorl as minute punctations, then become more intense and coalesce into distinct striations that term-

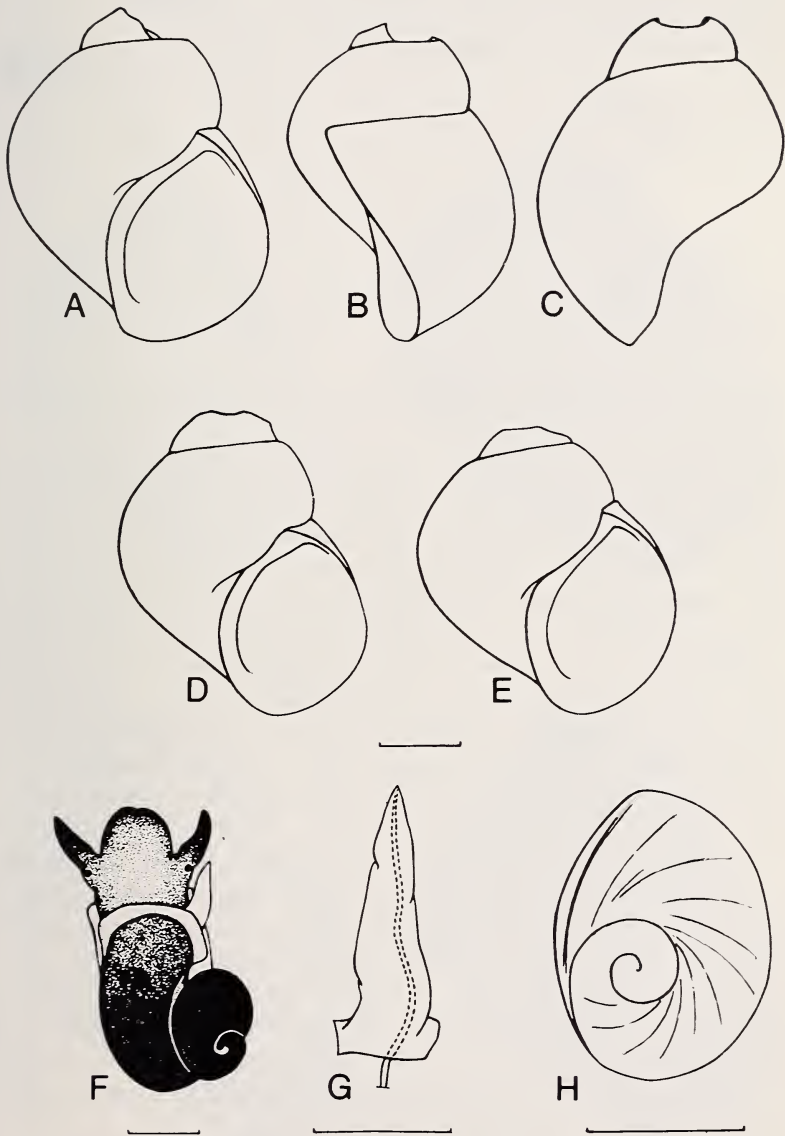


Fig. 8. *Somatogyrus (Walkerilla) tenax* n.sp. A-C, holotype. D-E, paratypes. F, Dorsal view of male denuded of shell. G, dorsal view of verge. H, operculum. Scales equal 1 mm.

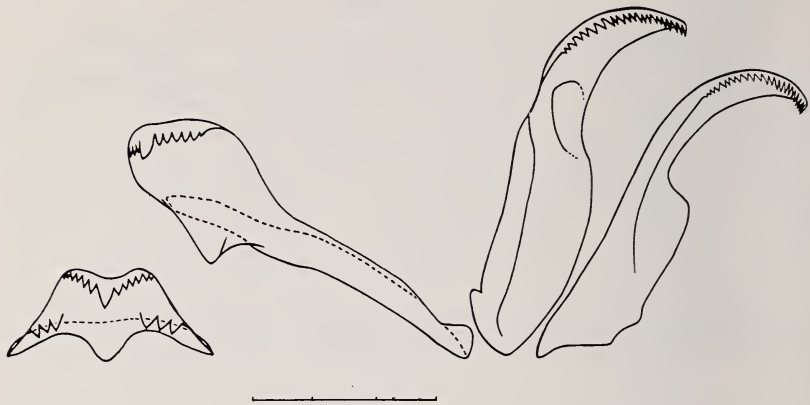


Fig. 9. *Somatogyrus (Walkerilla) tenax* n.sp. Radula. Scale equals 30  $\mu$ .

inate at the end of the apical whorl where the striations are slightly oblique. Remaining whorls sculptured with irregular incremental striations that become more intense on the body whorl. Body whorl weakly convex above periphery, more rounded below. Aperture ovate, 0.79-0.86 times as wide as high; height of aperture 0.69-0.75 times height of last whorl. Axis of aperture at about  $30^\circ$  to axis of shell. Plane of aperture at about  $45^\circ$  to shell axis. Peristome continued across parietal wall by a moderately thick callus, lower outer margin strongly indented, baso-columellar margin nearly vertical. Columella thick, concave, obliquely flattened to plane of aperture, considerably wider than parietal callus. Parietal callus nearly straight, only slightly convex.

Measurements (holotype in parenthesis): length of eroded adult shells, 3.3-4.0 mm (4.0); height of body whorl, 3.0-3.5 mm (3.5); width of shell, 2.9-3.3 mm (3.3); aperture height, 2.2-2.4 mm (2.4); aperture width, 1.8-2.0 mm (2.0).

OPERCULUM (Fig. 8, H). Ovate, chitinous, amber colored, consisting of about 2.2 whorls. Nucleus located at about 1/3 of distance from base to apex and from columellar margin to outer margin. Last whorl rapidly increasing in size. Outer surface with fine incremental striations.

ANIMAL (Fig. 8, F). Foot short and bluntly lanceolate, widest anteriorly, bluntly rounded posteriorly. Snout, pedicel and sides of foot dark fuscus; muzzle, tentacles and anterior

margin of foot nearly black. Mantle collar light grayish-orange. Mantle nearly black, becoming more intensely so on apical whorl of viscera. Tentacles moderately stout, tapered. Eyes located at outer base of tentacle.

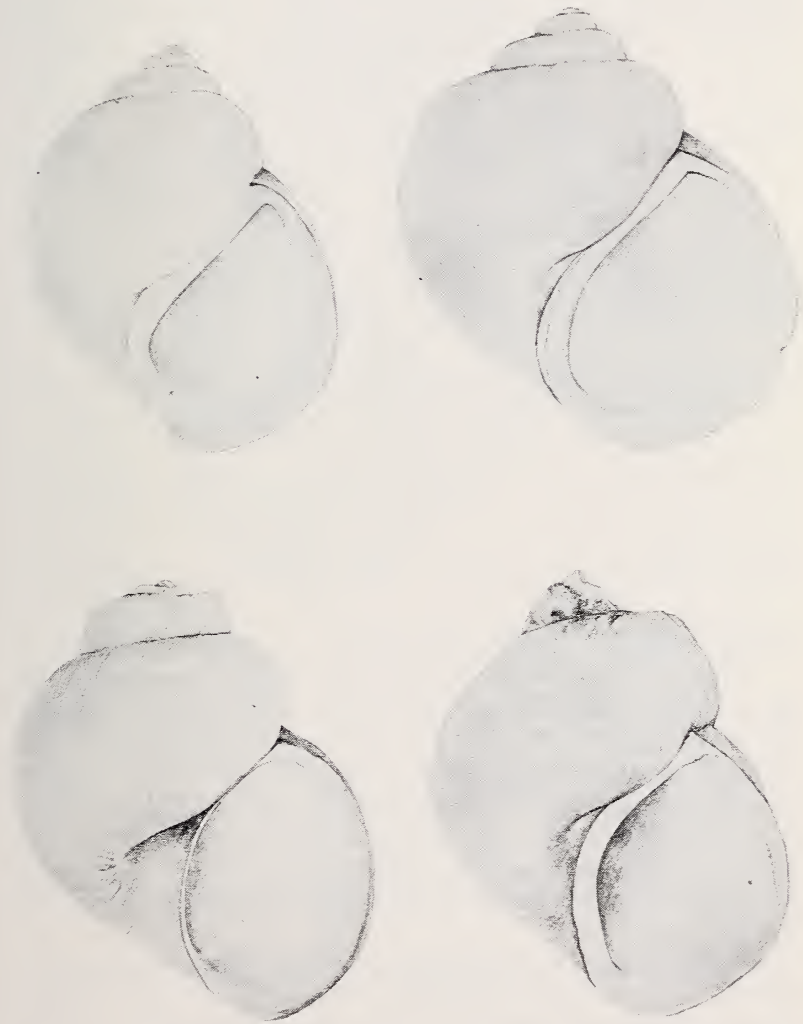


Fig. 10. Holotype of new Hydrobiidae. Upper left, *Rhapinema dacryon* n.gen. et n.sp. Upper right, *Notogillia sathon* n.sp. Lower left, *Spilochlamys turgida* n.sp. Lower right, *Somatogyrus (Walkerilla) tenax* n.sp.

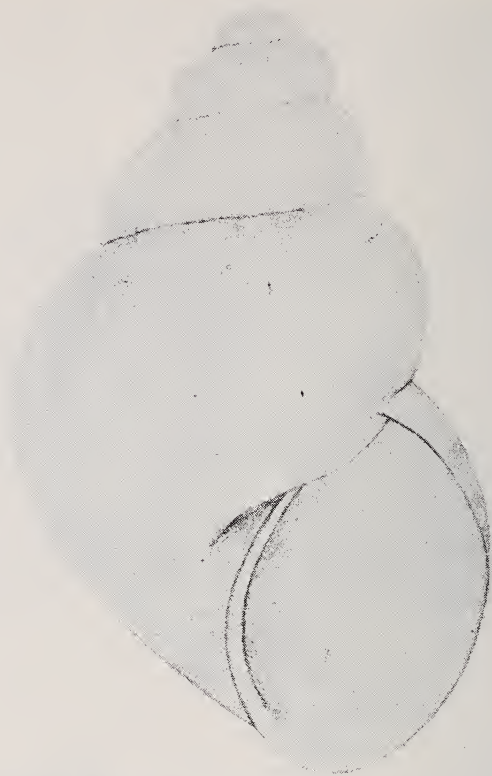


Fig. 11. *Marstonia agarhecta* n.sp., holotype.

VERGE (Fig. 8, G). Originating on the nape at a distance behind the right tentacle about equal to the length of the snout and just to the right of the mid-dorsal line. Verge directed toward the right at its base and then flexed anteriorly so that it lies behind the right tentacle when erect. Verge simple, conical, oval in cross section with the thickest part near the right margin. Verge gradually tapering to a fine point. Vas deferens simple, extending to the tip of the verge and lying along the right margin.

RADULA (Fig. 9). Consisting of about 51-78 transverse rows of teeth (10 specimens examined). Central tooth about  $35\mu$  wide and bearing 4-6 ectocones and 3 basocones on each side. The lateral tooth is similar in shape to that of *Clappia clappi* (Walker) (= *C. umbilicatus* Walker: see Goodrich, 1944:10) as described and



illustrated by Walker (1909, p. 89; Pl. VI, fig. 7). It is hatchet shaped with 3-1-5 or 3-1-6 relatively small cusps along the upper margin and a very large cusp along the base. The inner and outer marginal teeth bear about 20 minute cusps each.

TYPE LOCALITY. Broad River, 5.1 miles southwest of Bowman, Elbert County, Georgia. HOLOTYPE: UF 20530; collected 15 January 1969 by Fred G. Thompson. PARATYPES: UF 20531 (386); same data as the holotype.

Snails were collected in shallow rocky rapids from on the underside of small rocks and cobbles. Occasional specimens were found on *Sagittaria* stems in shallow riffles.

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